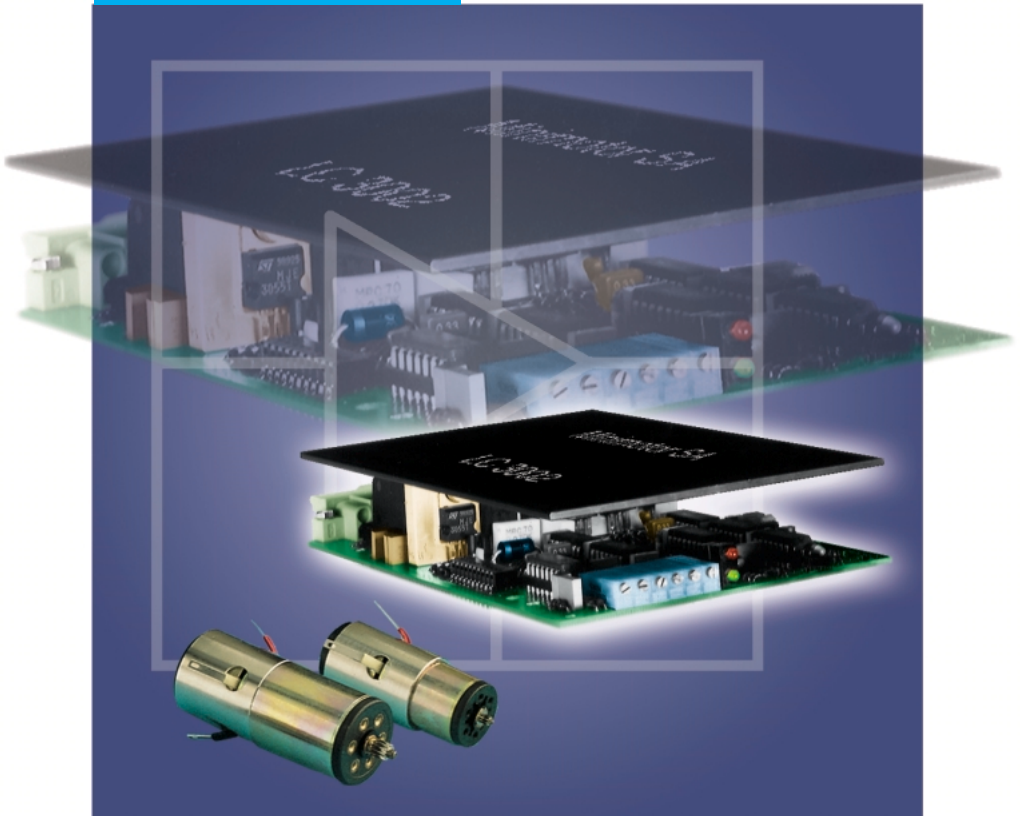




Linear Controller

4-Quadrant for DC-Micromotors

Series LC 3002



Miniature Drive Systems

Micro Drives
DC-Micromotors
Precision Gearheads
Servo Components
Drive Electronics

Surf to the following Internet address and you will find the latest edition of the instruction manual on-line:

www.minimotor.ch/uk/pr/

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Drive Electronics

Type	Motor type	Function	Operating mode	Current control	Speed control	Power supply (V DC)	Current limit (A)	Instruction manual Download
LC 3002	Brush comm.	4-Quadrant	Linear	Yes	Yes	12 - 32	2	IM (841 kB)
MCDC 2805	Brush comm.	4-Quadrant	PWM	No	Yes	12 - 28	10	IM (674 kB)
MCDC 3603	Brush comm.	4-Quadrant	PWM	No	Yes	12 - 36	3	IM (3258 kB)
MCDC 5004	Brush comm.	4-Quadrant	PWM	No	Yes	12 - 50	10	IM (3407 kB)
BLD 3502	Brushless	2-Quadrant	PWM	No	Yes	12 - 35	3	IM (829 kB)
BLD 5603	Brushless	4-Quadrant	PWM	Yes	Yes	14 - 56	4	IM (1677 kB)
BLD 5604	Brushless	2-Quadrant	PWM	No	Yes	10 - 56	4	IM (661 kB)
BLD 5606	Brushless	4-Quadrant	PWM	Yes	Yes	14 - 56	8	IM (1677 kB)
BLD 5608	Brushless	2-Quadrant	PWM	No	Yes	10 - 56	8	IM (661 kB)
MCBL 2805	Brushless	4-Quadrant	PWM	No	Yes	12-28	10	IM (795 kB)
MCBL 3603	Brushless	4-Quadrant	PWM	No	Yes	12 - 36	3	IM (3258 kB)
MCBL 5004	Brushless	4-Quadrant	PWM	No	Yes	12 - 50	10	IM (3407 kB)

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For direct Download:

http://www.minimotor.ch/minicatalog/pdf/DriveCircuits/Manuals/IM_e_LC_3002.pdf



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Series LC 3002

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CAUTION:

Use the Servo Amplifier only in accordance with the set-up checklists on page 8.



Linear Controller

Series LC 3002

1. Description

The linear 4-quadrant Servo Amplifier LC 3002 is designed for use with highly dynamic brush commutated DC-Micromotors which feature ironless rotors (System Faulhaber®).

The linear design assures that no electromagnetic radiation is generated and eliminates the need for motor inductors.

The Servo Amplifier LC 3002 can be used in a variety of configurations such as:

- **Motor-Tacho Feedback** control (Speed control)
- **IR Compensation** control (Speed control)
- **Voltage drive** (Voltage control)
- **Current control** (Torque control)

The Servo Amplifier can be used either with DC or AC supply voltage.

Technical specifications

	Minimum	Typical	Maximum	Unit
Nominal power ¹⁾	–	20	40 ²⁾	W
Power supply voltage:				
– DC supply	12	–	32	V DC
– AC supply	10	–	22	V AC
Motor supply voltage	–	–	26	V DC
Output current max.	–	2	–	A
Tachogenerator voltage	–	–	50	V
Reference voltage	–	±3 ³⁾	–	V
Command voltage	–	±10	–	V
External command voltage I-dyn	–	0–10	–	V
Fault output (open collector)	24 V DC – 20 mA max.			
Temperature range:				
–operation	0	–	+70 ⁴⁾	°C
–storage	–20	–	+80	°C
¹⁾ Maximum power which can be dissipated by the Servo Amplifier ²⁾ With additional heat sink ³⁾ Supply voltage for externally set potentiometer ⁴⁾ Derating at higher temperature to be taken in consideration				

3. Dimensions and weight

Size (Euro format)	100 x 160 mm
Width	6 TE (30,48 mm)
Weight	300 g

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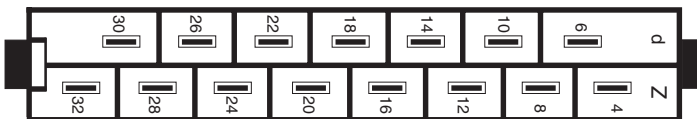
Series LC 3002

4. Connector / Pin location

The Servo Amplifier LC 3002 is supplied standard with a 15-pin connector type DIN 41612.

4	Power supply voltage AC/DC +
6	Power supply voltage AC/DC –
8	GND
10	Motor supply voltage +
12	Motor supply voltage –
14	Reference voltage output –
16	Reference voltage output +
18	Speed or torque command +
20	Speed or torque command –
22	Current limiter I_{dyn} +
24	Current limiter I_{dyn} –
26	Tachometer +
28	Tachometer –
30	Enable input
32	Fault output

Type H15





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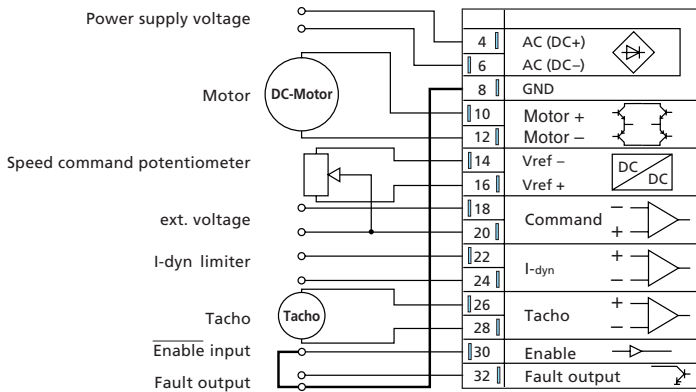
Series LC 3002

5. Wiring diagram for Motor-Tacho feedback control (Speed control)

The actual motor speed is sensed with the tachogenerator.

The reference command signal is given either with an external voltage of ± 10 V or through a potentiometer directly connected to the amplifier.

The total resistance of this potentiometer should be between 10 k Ω and 47 k Ω .

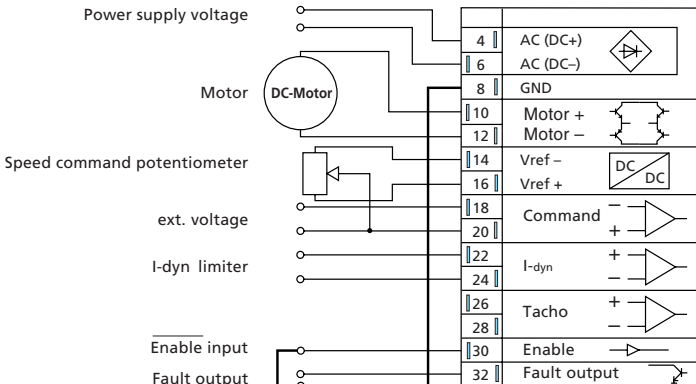


6. Wiring Diagram for IR Compensation (Speed control)

The actual motor speed is determined by the motor voltage and motor current.

The speed reference command is connected either through an external ± 10 V or through a potentiometer directly connected to the amplifier.

The total resistance of this potentiometer should be between 10 k Ω and 47 k Ω .

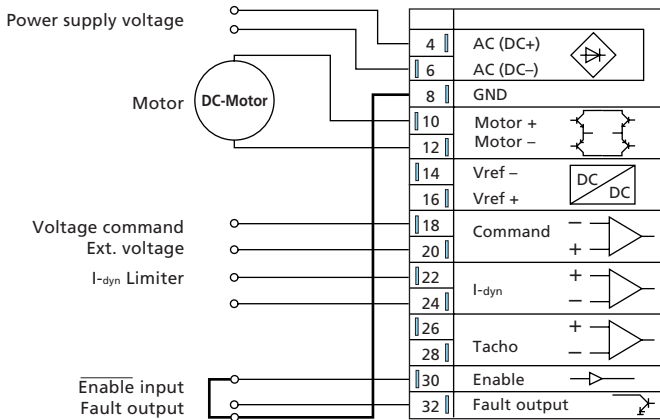


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Series LC 3002

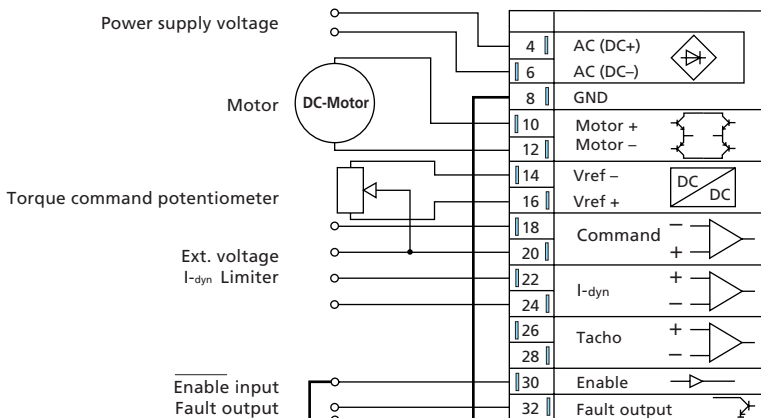
7. Wiring diagram for Voltage drive (Voltage control)

Setting of a constant motor voltage (the motor speed is about proportional to the voltage).
The reference command value is determined by an external voltage of ± 10 V.



8. Wiring diagram for Current control (Torque control)

The actual torque is measured with the motor current.
The reference command value is determined by an external voltage of ± 10 V or through a potentiometer directly connected to the amplifier.
The total resistance of this potentiometer should be between 10 K - 47 K Ohms.



Linear Controller

Series LC 3002

9. Enable input

The Servo Amplifier LC 3002 is enabled when pins 8 and 30 are connected.

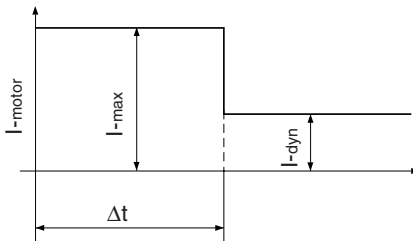
Opening this connection disables the power stage. This input must be connected via a potential-free contact (e.g.: relay contact).

10. Current limiter

The maximum continuous current is set with the dynamic current limiter (I_{dyn}).

This current can be exceeded for a short time up to the set value I_{max} (typical 2 A).

In the event of short circuit (i.e., current greater than 3,5 A) the amplifier is immediately disabled.



Δt = depending on the charge process of an integrator.

11. Excess temperature protection

The system automatically shuts off if the heat sink temperature exceeds 80°C, preventing damage of the power bridge.

12. Fault output

The Servo Amplifier LC 3002 uses an open collector output on pin 32 (Figure 1).

The fault output is activated in the following situations:

- Activated dynamic current limiter
- Motor in short circuit
- Excess temperature on heat sink

At the Fault Output either an LED (Figure 2) or a relay (Figure 3) can be connected.

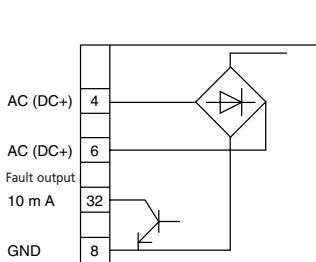


Figure 1

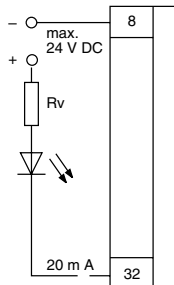


Figure 2

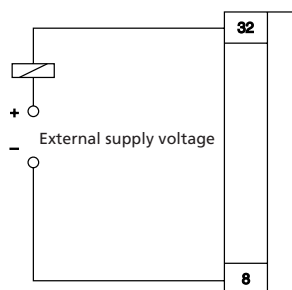


Figure 3

Linear Controller

Series LC 3002

13. DIP Switch settings for various operating modes

Operating mode / DIP Switches	1	2	3	4	5	6	7	8	9	0
Motor-Tacho regulation (Speed control)			on	A		on	on	on		B
IR regulation (Speed control)			on	A	on	on			on	B
Voltage drive regulation (Voltage control)			on			on			on	B
Current control regulation (Torque control)		on		A						B

A. DIP Switch 4

This switch should be **off** if the command signal comes from a potentiometer connected to the V_{ref} terminals. This switch should be **on** if an external voltage is used.

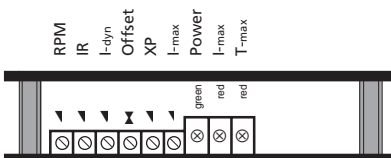
B. DIP Switch 0

This switch should be **on** when the dynamic current limit I_{dyn} is set using the on-board trimmer. This switch should be **off** if the dynamic current limit I_{dyn} is externally set.

14. On-board trimmers and LEDs

The on-board trimmers have a twenty (20) turn range. Before operating the amplifier the trimmers have to be set according to the following table.

		Position	Function	
RPM	CCW	Min. speed	Speed selection	
IR	CCW	Min. stiffness	IR compensation	
I-dyn	CW	Max. continuous current	Continuous current	
Offset	Middle		Zero output balance	
XP	CCW	Min. stiffness	Amplification control	
I-max	CW	Max. intermittent current	Short duration current	
LED1		Power	Power supply indicator	Green
LED2	>	I-max	On if I-max is exceeded	Red
LED3	>	T-max	On if excess temperature	Red



Note:

In different operating modes not all trimmers will be used. Unused trimmers should be set to the positions given in the table.



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15. RPM setting

Scope: The desired max. motor speed is set with the RPM trimmer.

Action: Input a reference command voltage or set a value via external potentiometer according to the desired max. speed.

Turn the RPM trimmer CW until the motor reaches a speed corresponding to the max. set value.

16. I_{max} setting

Scope: The desired max. peak current is set with the I_{max} trimmer.

Action: Use a digital amp. meter connected in series with motor. Stall the motor.

Turn the I_{max} trimmer CCW until the max. permissible current is reached.

Note: Make this adjustment as fast as possible, since the dynamic current limiter will be activated after a short period of time.

17. I_{dyn} setting

Scope: The dynamic current limitation is set with the I_{dyn} trimmer.

Action: Use a digital amp. meter connected in series with motor. Stall the motor.

Turn the I_{dyn} trimmer CCW until the max. permissible continuous current is reached.

18. XP setting

Scope: The amplifier's gain and therefore also its operating stability (stiffness) is set with the XP trimmer.

Action: Run the motor at a low speed by input of a corresponding set value.

Turn the XP trimmer CW until the motor starts vibrating (swinging), then turn the trimmer one full turn CCW.

19. IR setting

Scope: The amplifier's gain and therefore also its operating stability (stiffness) is set with the IR trimmer.

Action: Run the motor at a low speed by input of a corresponding set value.

Turn the IR trimmer CW until the motor starts vibrating (swinging), then turn the trimmer one full turn CCW.

20. Offset setting

Scope: Zero speed or motor standstill between rotation directions is set with the offset trimmer.

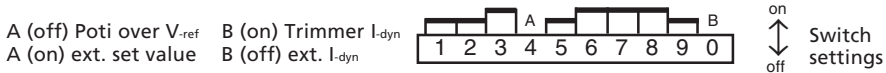
Action: Input 0 (zero) set value. Turn the offset trimmer CW or CCW until the motor shaft does not turn.

Linear Controller

Series LC 3002

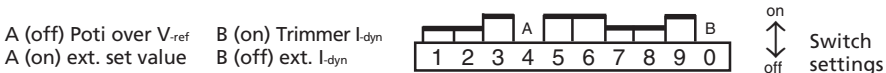
21. Checklist for Motor-Tacho Feedback control (Speed control)

Action	References
– Connect the LC 3002	5 Wiring diagram Motor-Tacho Feedback control
– Preset potentiometer	14 On-board trimmers and LEDs
– Set operation mode, apply power	13 DIP Switch settings for various operating modes
– Set RPM	15 RPM setting
– Set I-max	16 I-max setting
– Set I-dyn	17 I-dyn setting
– Set XP	18 XP setting
– Set offset	20 Offset setting



22. Checklist for IR Compensation (Speed control)

Action	References
– Connect the LC 3002	6 Wiring diagram IR Compensation
– Preset potentiometer	14 On-board trimmers and LEDs
– Set operation mode, apply power	13 DIP Switch settings for various operating modes
– Set RPM	15 RPM setting
– Set I-max	16 I-max setting
– Set I-dyn	17 I-dyn setting
– Set IR	19 I x R setting
– Set offset	20 Offset setting



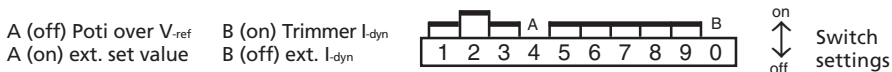
23. Checklist for Voltage drive (Voltage control)

Action	References
– Connect the LC 3002	7 Wiring diagram for Voltage drive
– Preset potentiometer	14 On-board trimmers and LEDs
– Set operation mode, apply power	13 DIP Switch settings for various operating modes
– Set RPM	15 RPM setting
– Set I-max	16 I-max setting
– Set I-dyn	17 I-dyn setting
– Set offset	20 Offset setting



24. Checklist for Current control (Torque control)

Action	References
– Connect the LC 3002	8 Wiring diagram for Current control
– Preset potentiometer	14 On-board trimmers and LEDs
– Set operation mode, apply power	13 DIP Switch settings for various operating modes



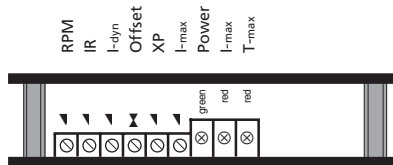


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25. Trimmer settings

RPM	CCW	Min. Speed
IR	CCW	Min. Stiffness
I-dyn	CW	Max. Continuous current
Offset	Center	
XP	CCW	Min. Stiffness
I-max	CW	Max. Current

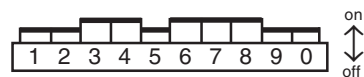
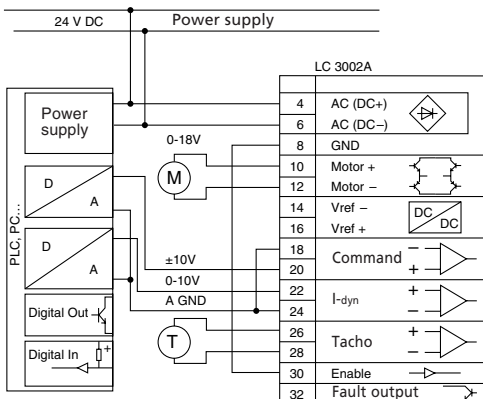


Note: Motor supply voltage selection

The voltage loss in the Servo Amplifier is 6 Volts. Therefore, the maximum possible motor supply voltage is always 6 Volts less the power supply voltage of the amplifier.

26. Connection example for Motor-Tacho Feedback control (Speed control), 24 V DC supply

Common supply. Set value and I-dyn via PLC, PC, etc., without enable control and failure scan.



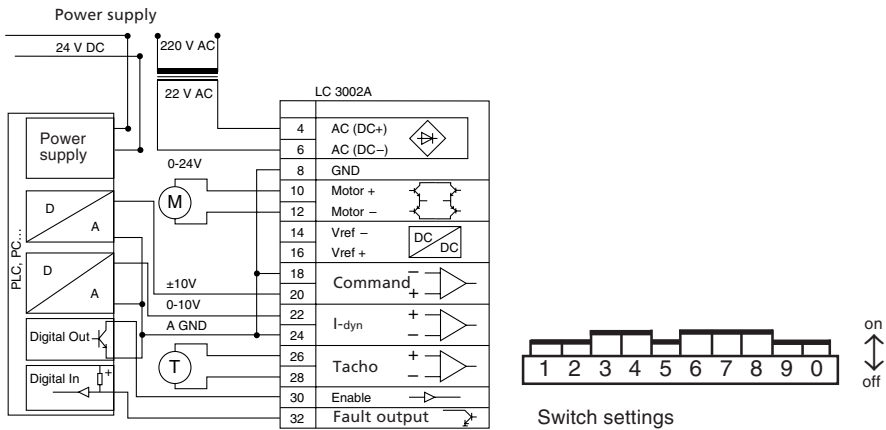
Switch settings

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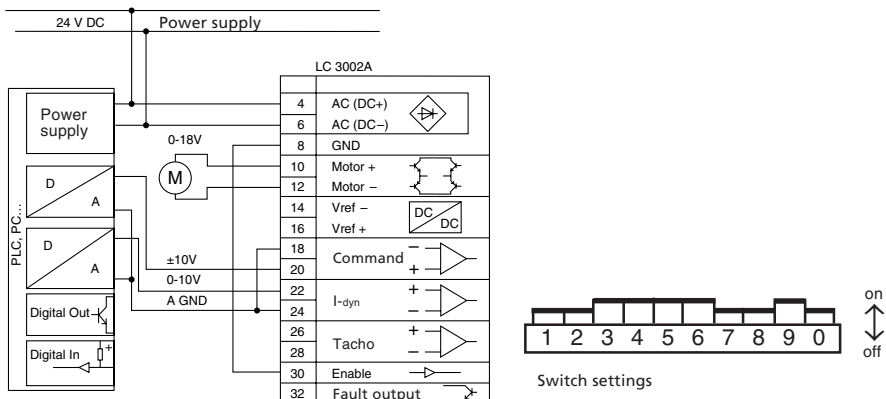
27. Connection example for Motor-Tacho Feedback control (Speed control), 22 V AC supply

Separate AC supply for the LC 3002. Set value and I_{dyn} via PLC, PC, etc., with enable control and failure scan.



28. Connection example for IR Compensation (Speed control)

Common supply. Set values RPM and I_{dyn} via PLC, PC, etc., without enable control and failure scan.

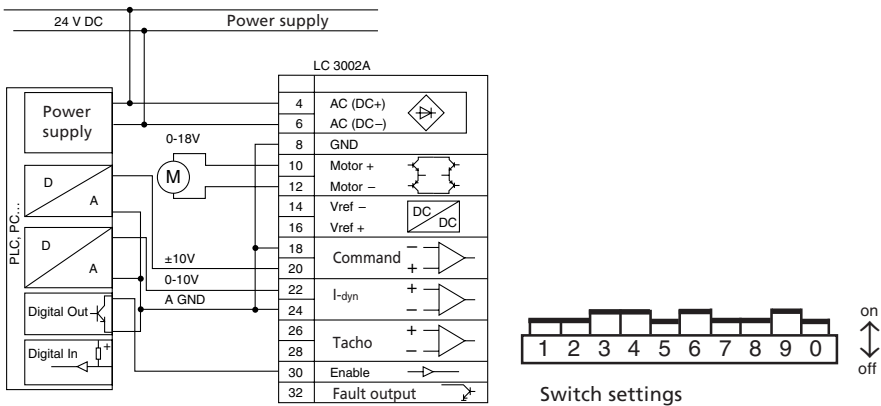


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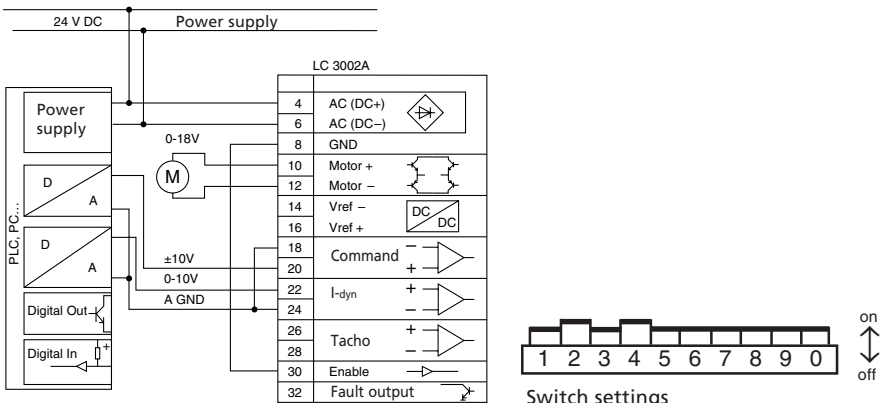
29. Connection example for Voltage amplifier (Power amplifier)

Common supply. Set value and I_{dyn} setting via PLC, PC, etc. Enable control via PLC, without failure scan.



30. Connection example for Current control (Torque control)

Common supply. Set value for torque and I_{dyn} via PLC, PC, etc., without enable control and failure scan.



**31. Trouble shooting**

If difficulties are experienced, please check the following points:

- Check connections:
 - Are motor leads reversed?
 - Are tacho leads reversed?
 - Is Enable (pin 30) connected to GND (pin 8)?
- Check DIP switch settings.
- Follow the checklists, in proper order (page 8).
- Always be sure that the potentiometers are in their starting positions.



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